

The potential hazard from storm surge and the CRISC project

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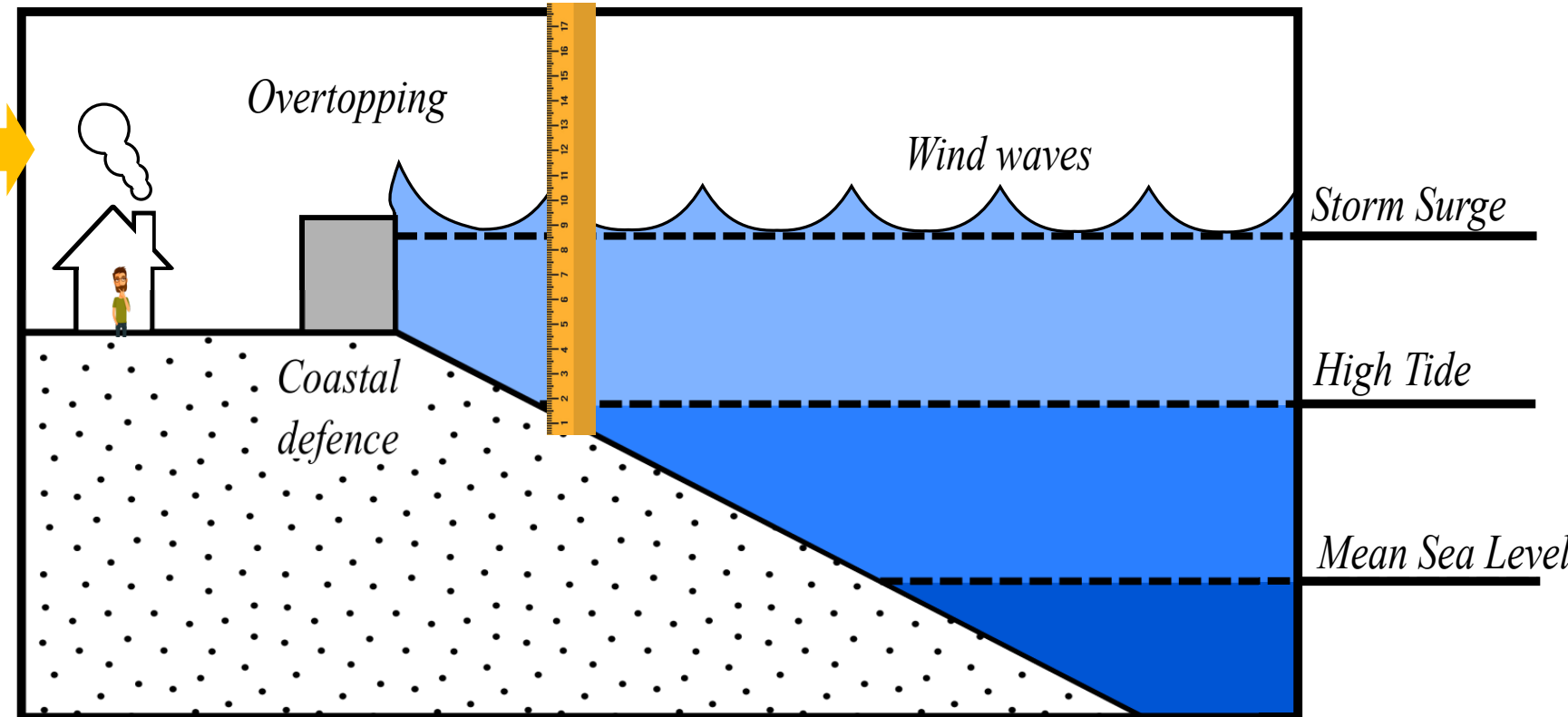
11th and 12th February 2020, Antananarivo, Madagascar

Coastal Water Level

Coastal water level changes all the time due to a number of factors, including...

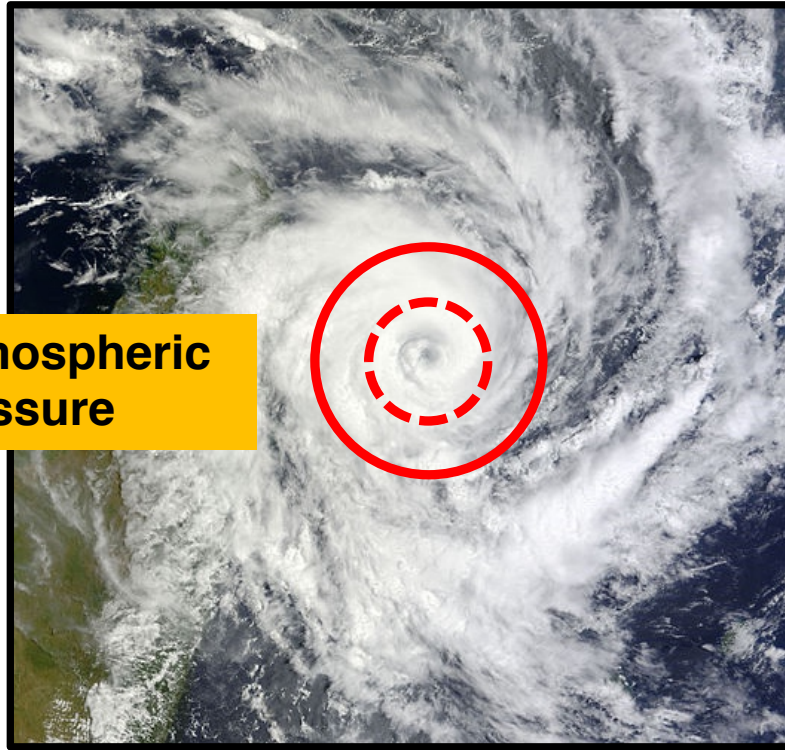
Antananarivo is far from coast, but Madagascar has:

- > 6000km of coastline
- 3-4 tropical cyclones p/year
- Ports and fishing villages at risk

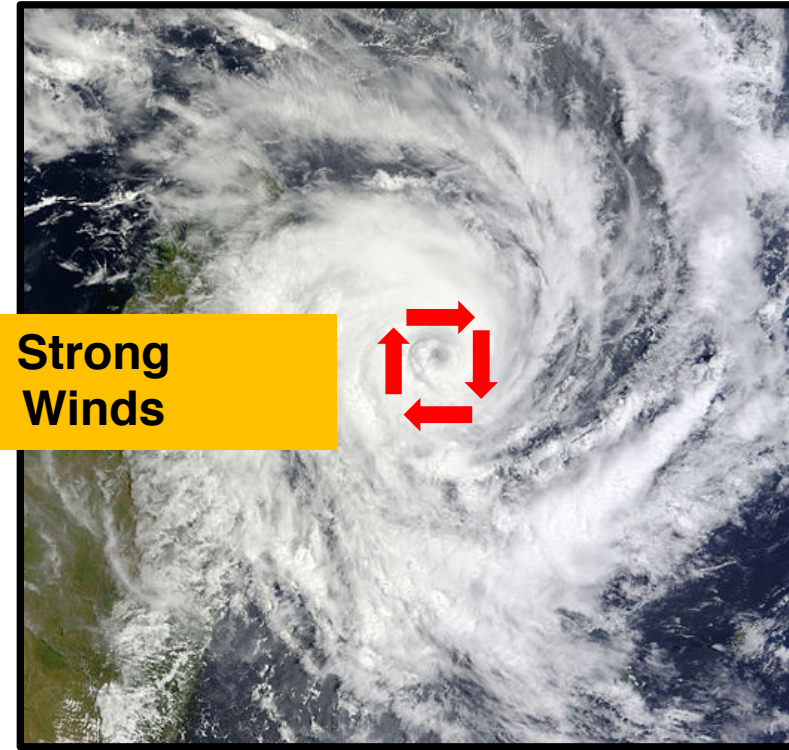


Storm Surge

**Low atmospheric
pressure**

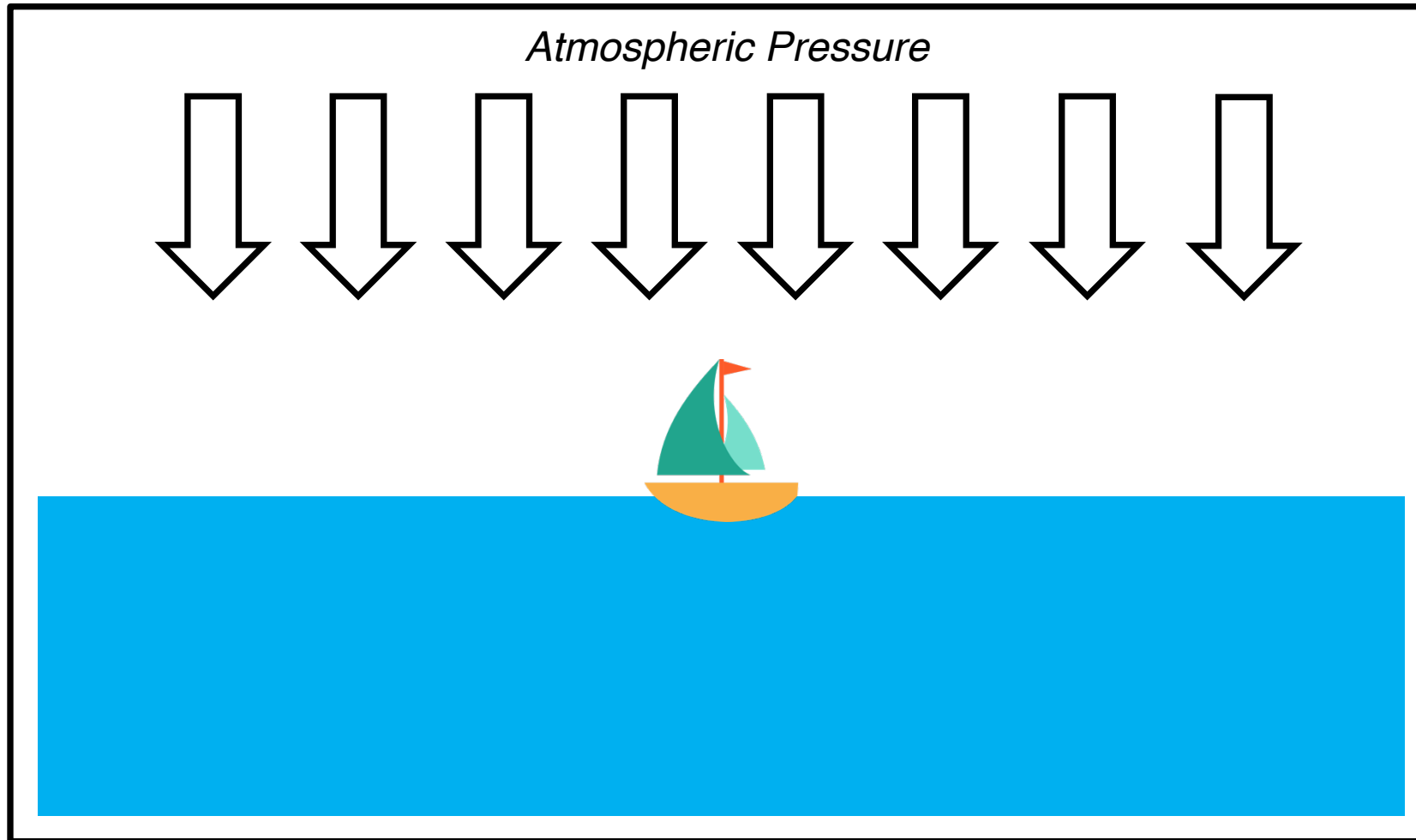


**Strong
Winds**



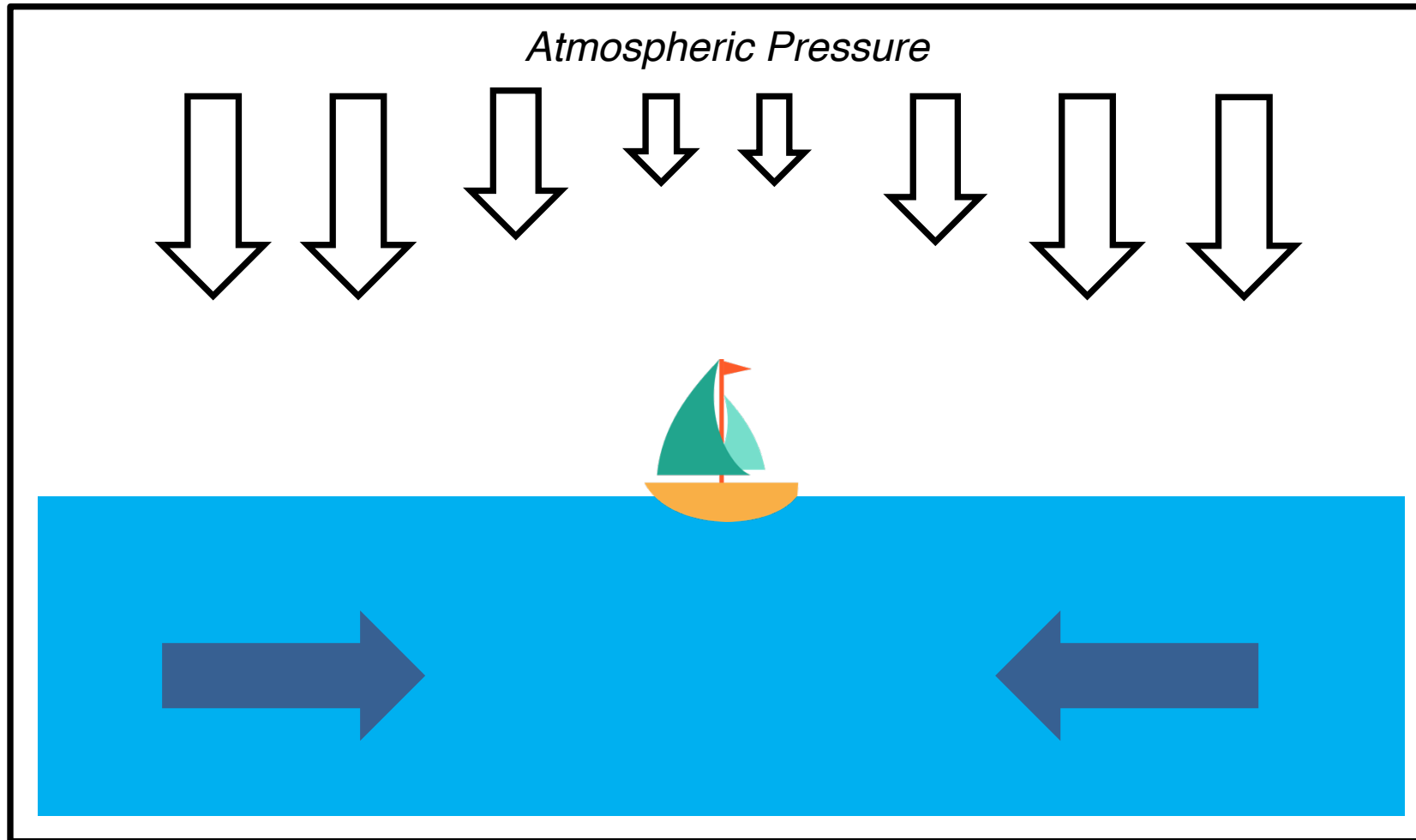
**Change to coastal sea level caused by the
weather, e.g. Tropical Cyclone/Hurricane**

Storm Surge: Low Pressure



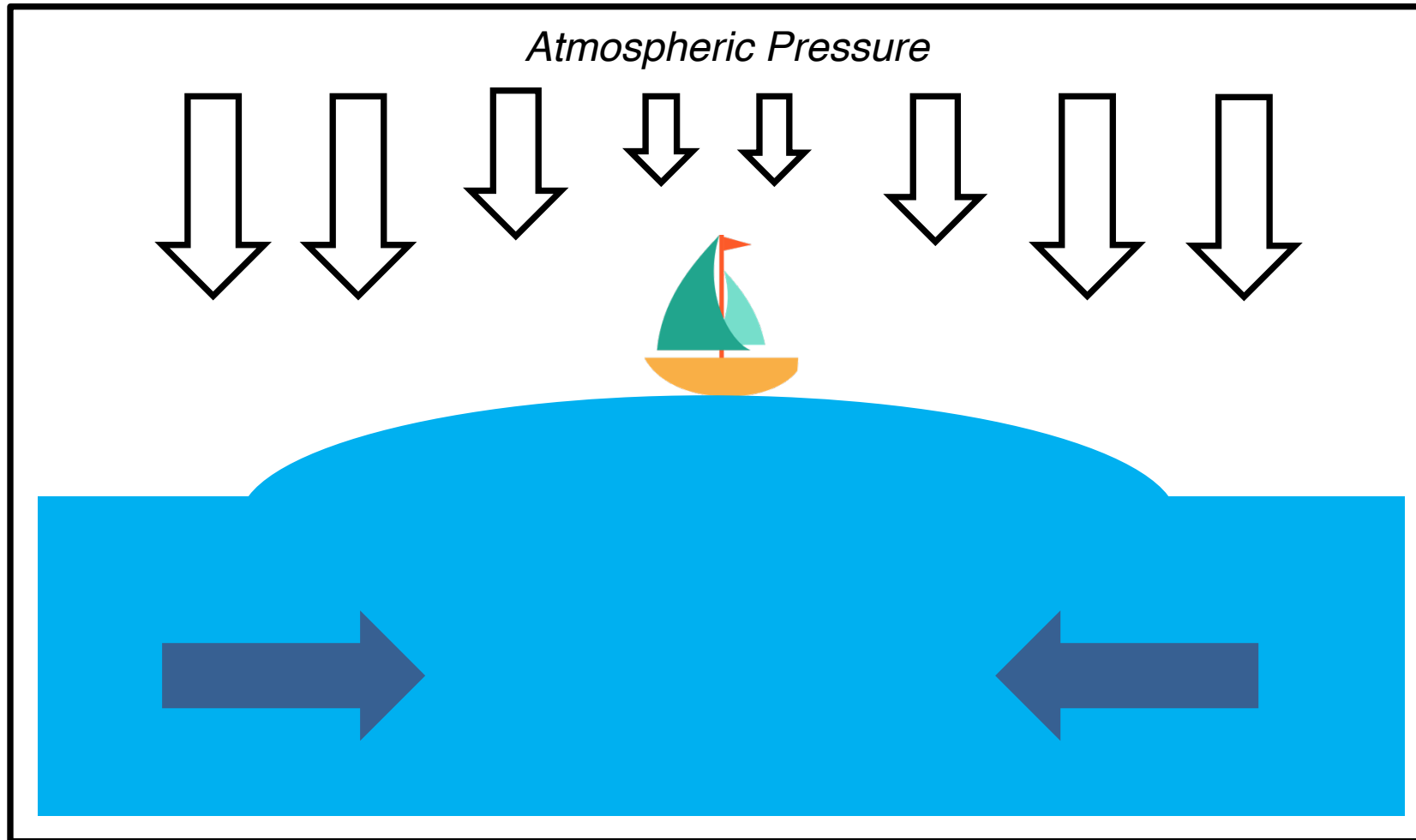
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Storm Surge: Low Pressure



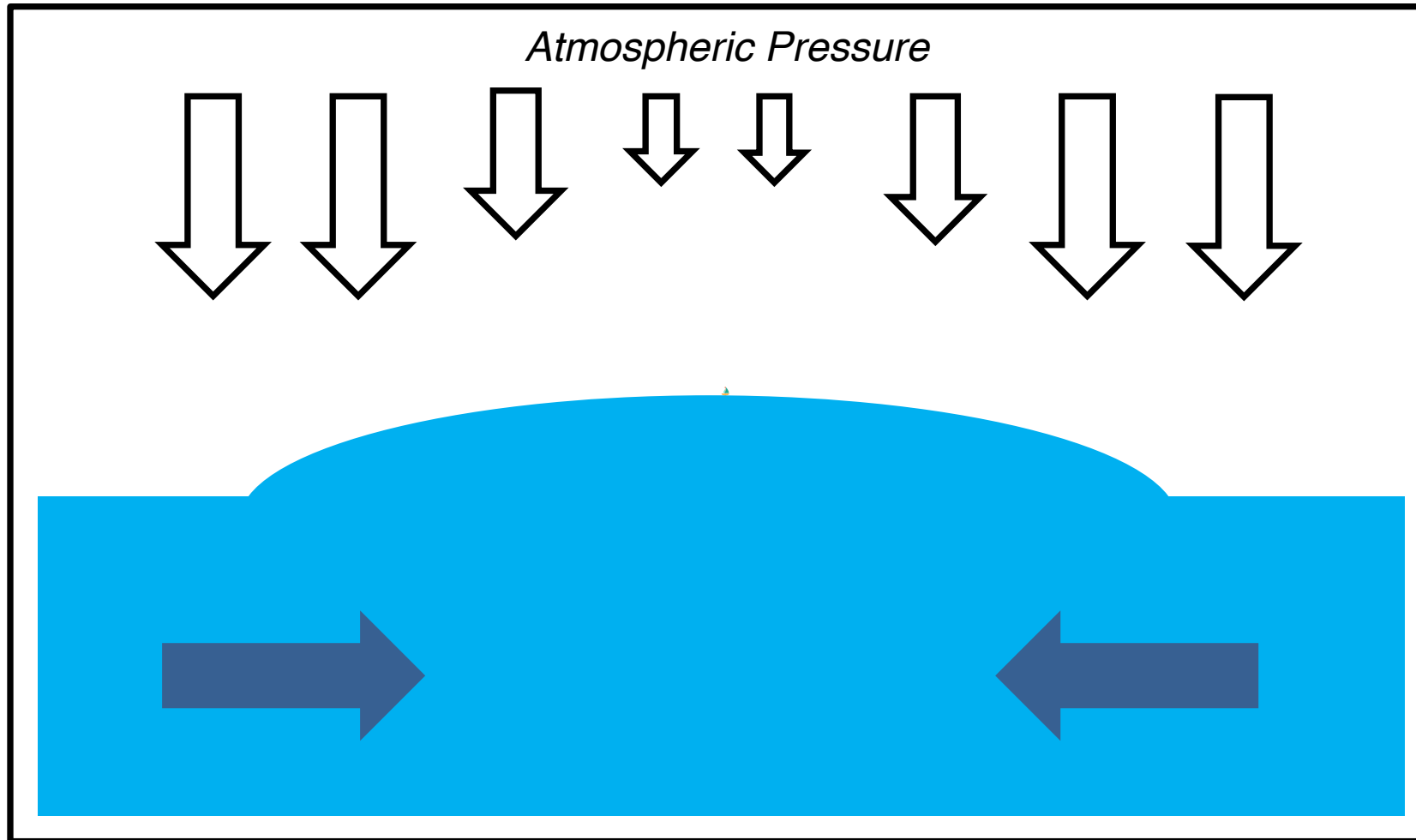
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Storm Surge: Low Pressure



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Storm Surge: Low Pressure

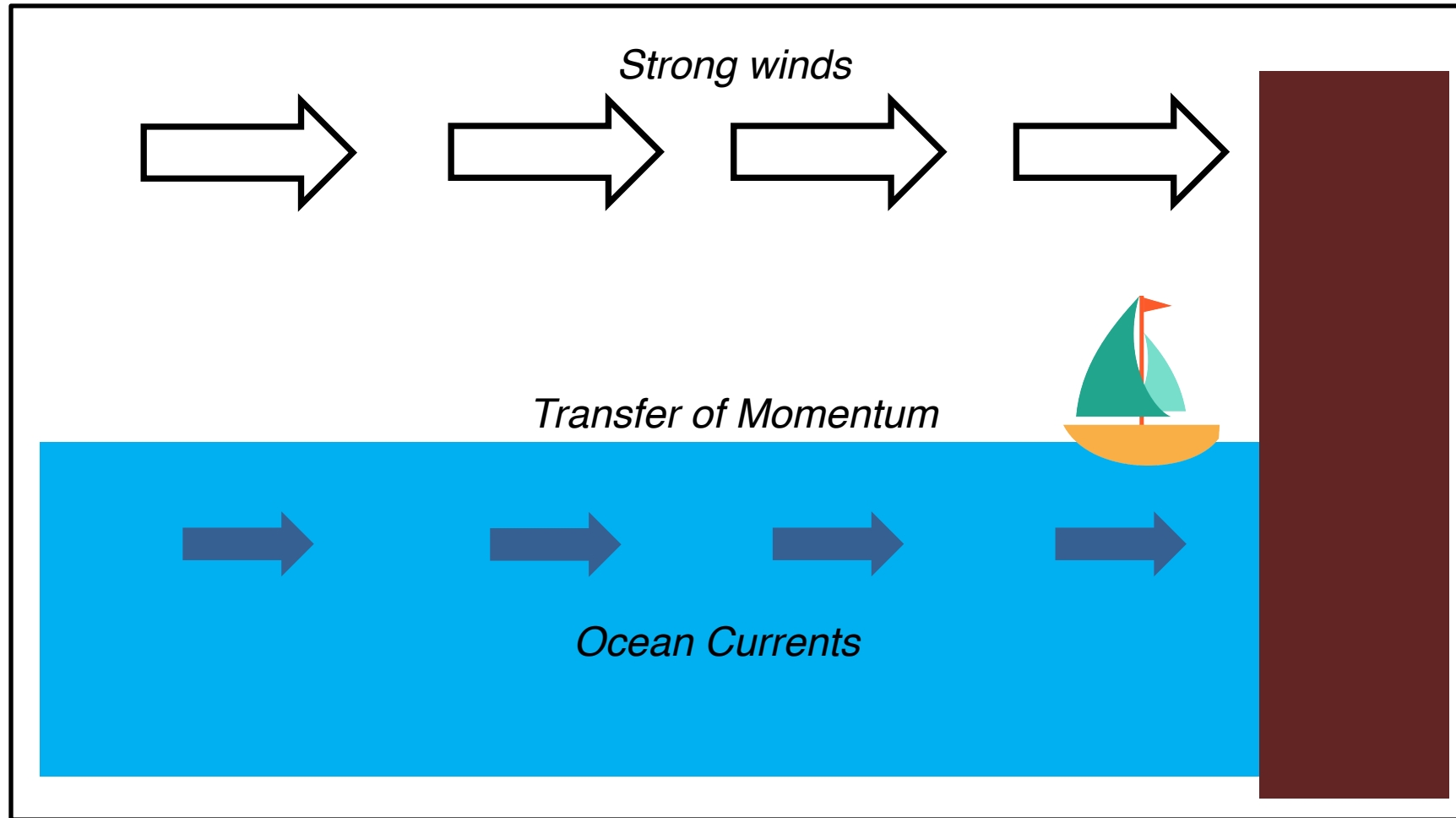


Approximation:
1 mbar lower =
1cm increase

Very strong tropical
cyclone -> 1m
increase

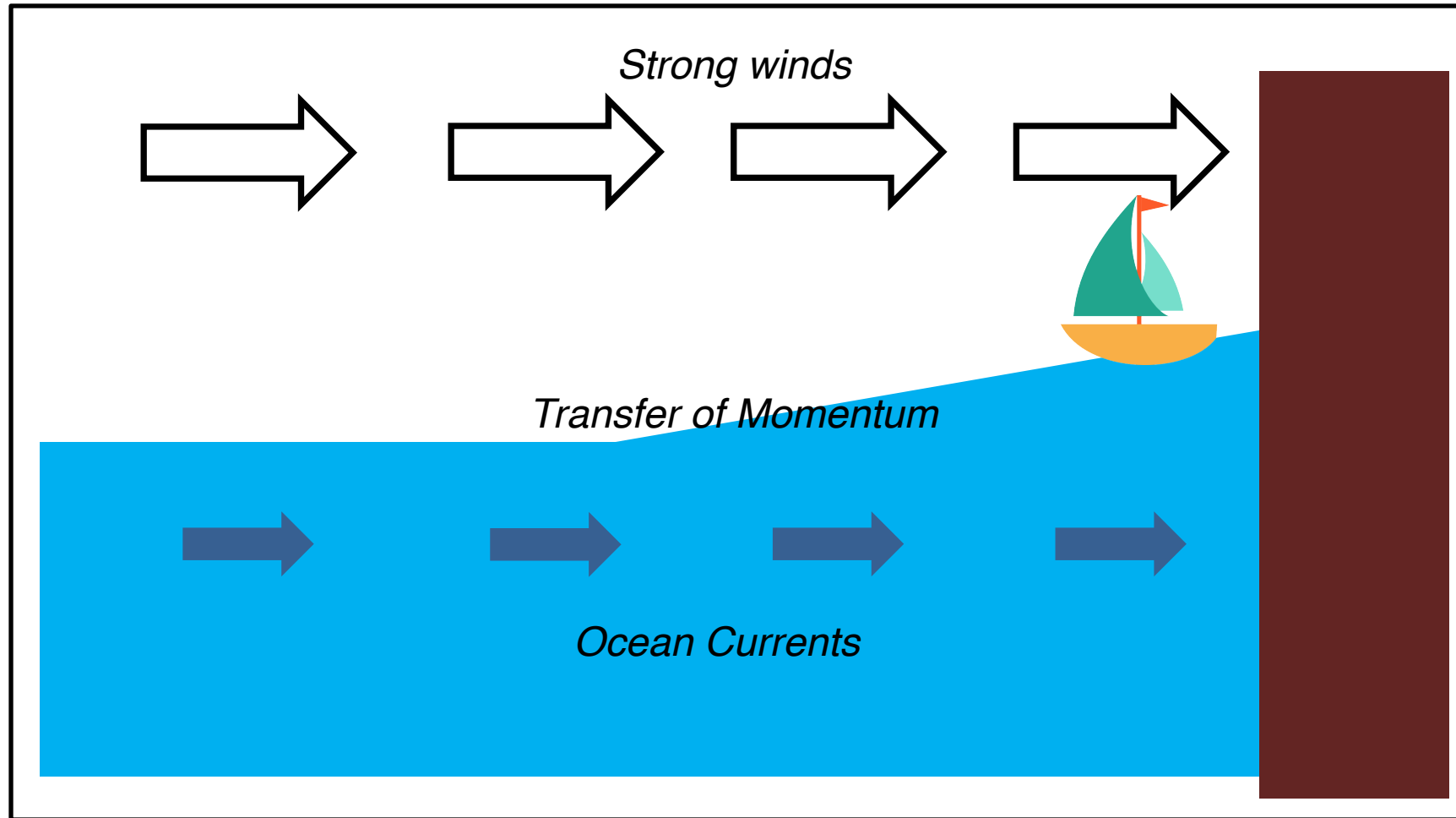
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Storm Surge: Strong Wind



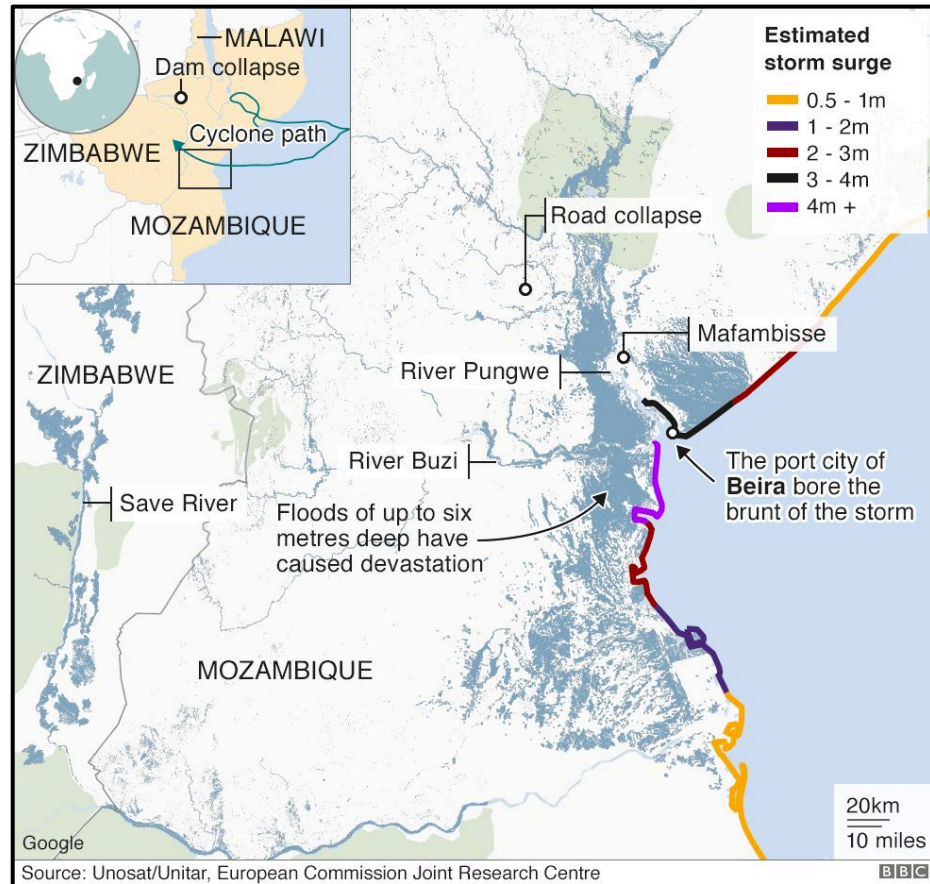
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Storm Surge: Strong Wind



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Storm Surge: Idai, Mozambique

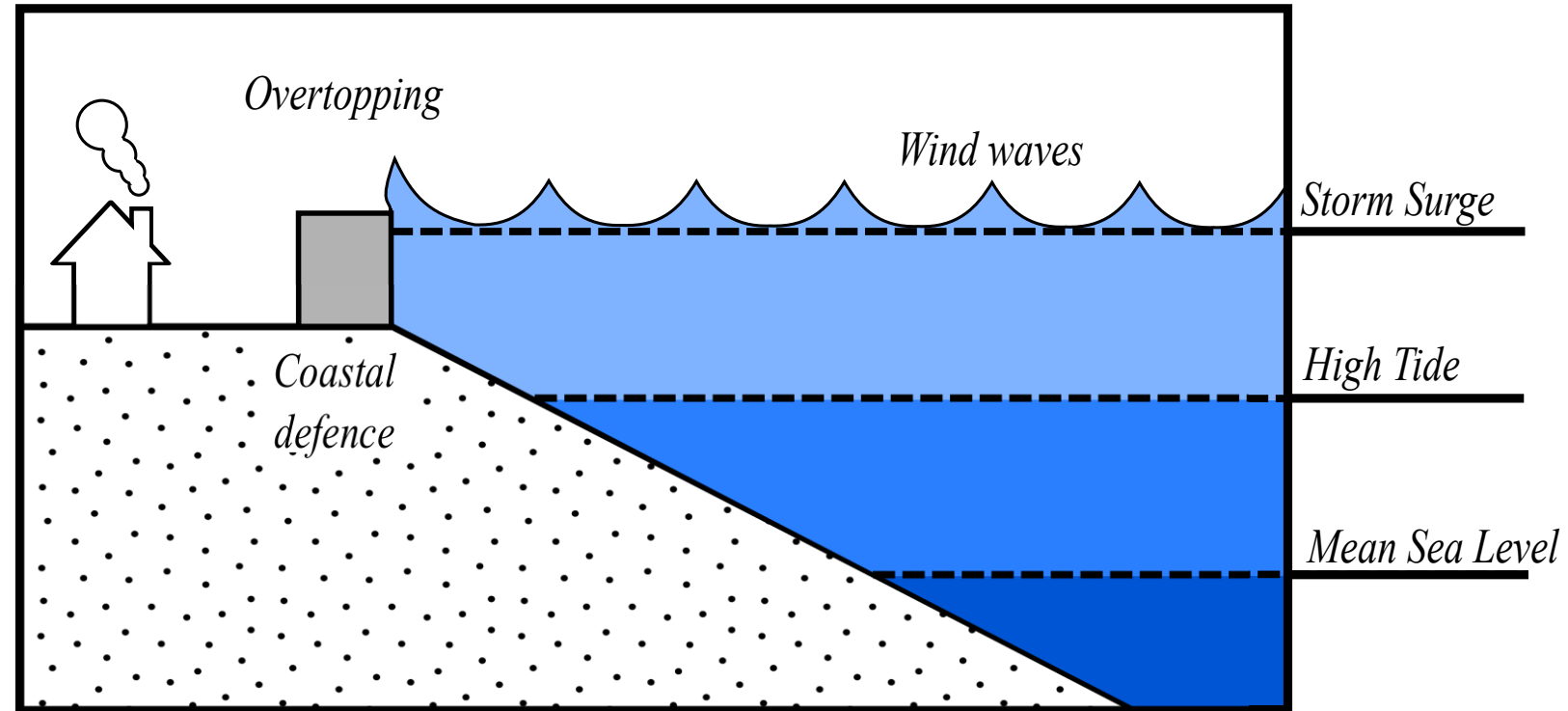


Coastal Flood Risk

Combination:

High tide + storm surge + large waves
= risks to coastal communities.

With climate change and sea level rise, the risk from storm surges will increase



Defending Against Storm Surges

Coastal defences can help protect areas at risk

- Many different types: manmade and natural. E.g. Mangroves.
- Decisions on type, location and size must be well-informed by using observed and modelled data

Forecasting can help preparation

- Typically using a computer model



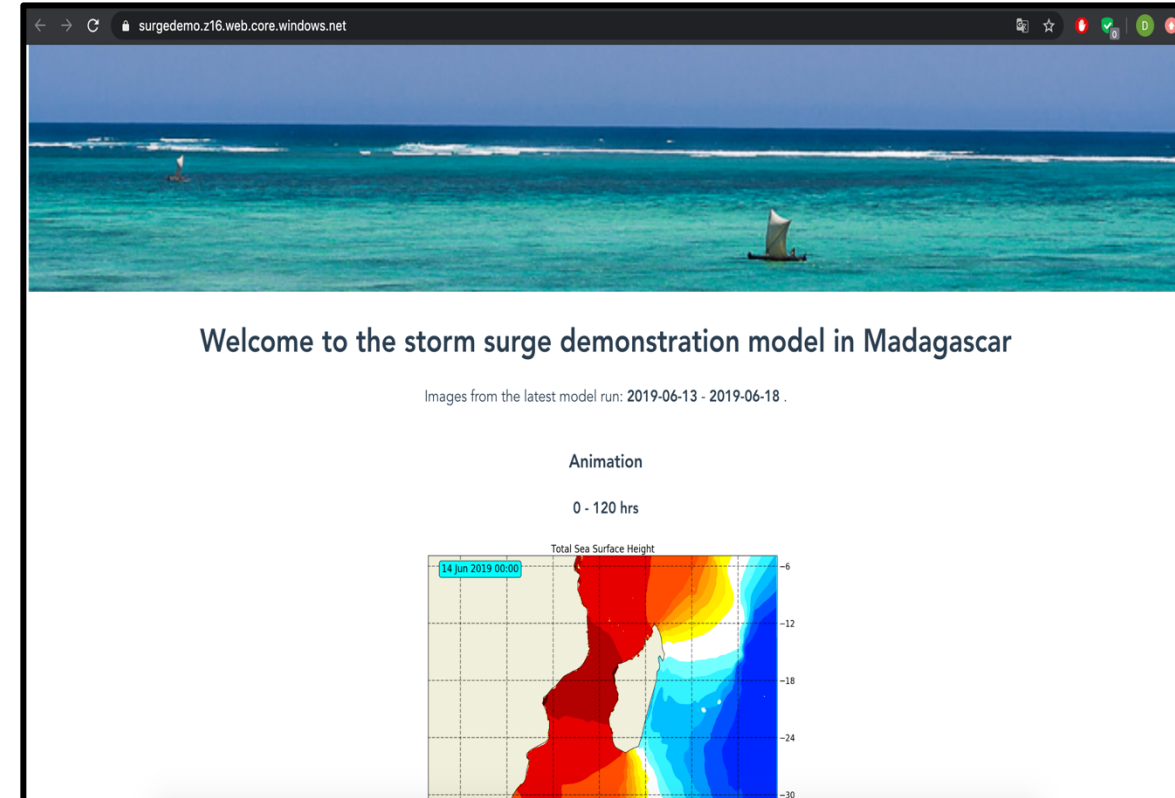
The CRISC Project

Project aim:

Create tools for cost effective creation of storm surge forecasts for any coastal region of the world.

Outcomes for Madagascar:

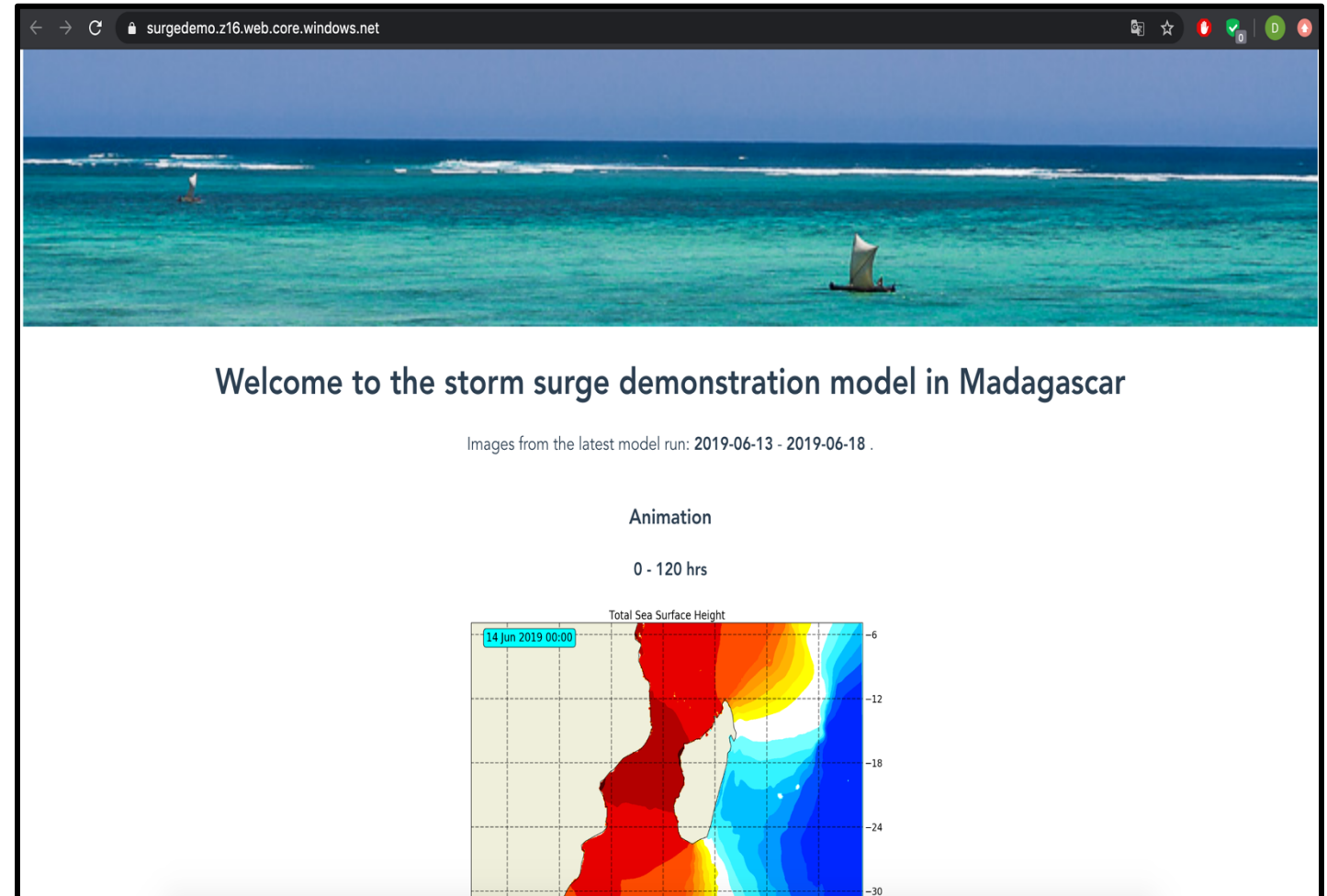
- Regional computer model for tides, storm surges and currents
- Live forecasting system for water level around Madagascar
- Demonstration website
- Simulation of hurricane storm surges



Forecasting System:

5-day sea level forecasts, updated daily

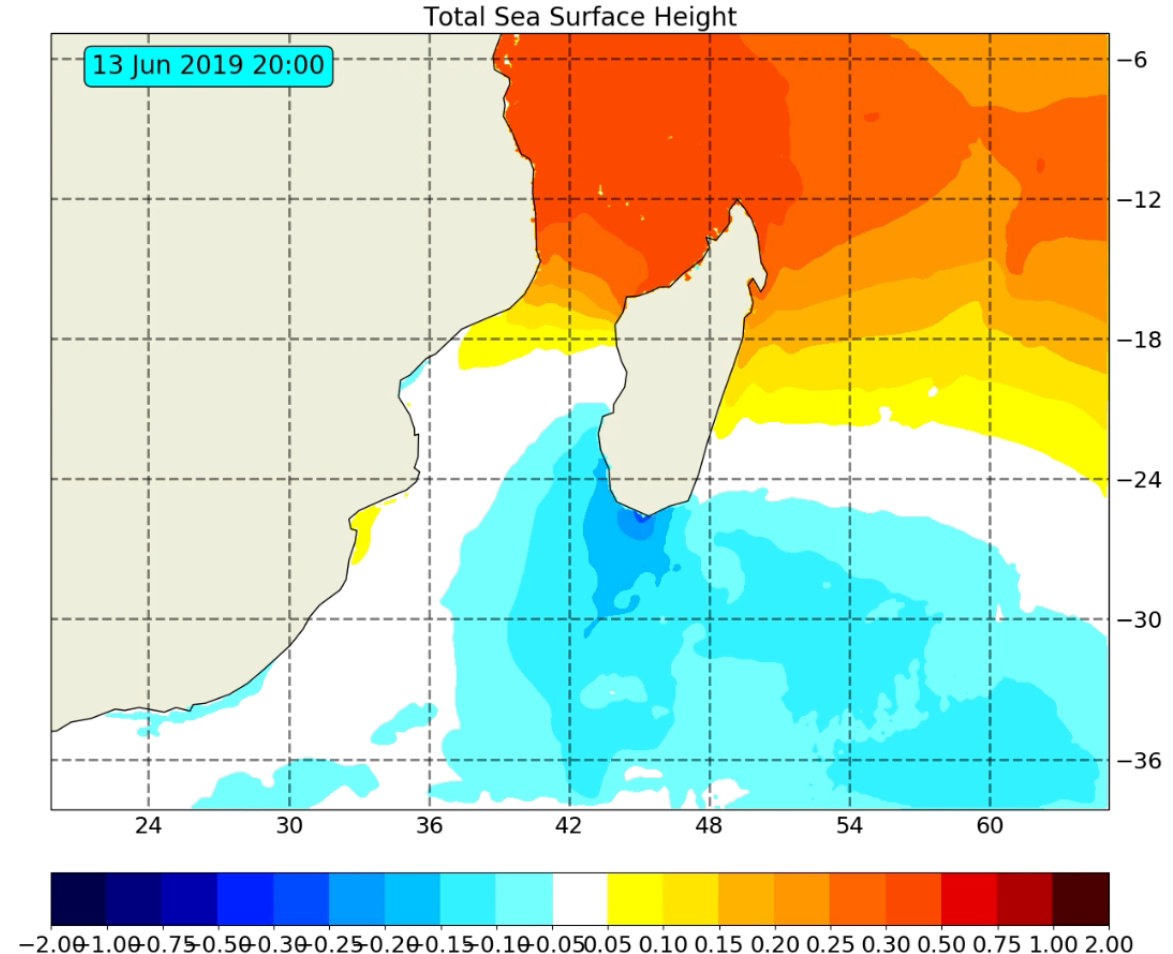
- NEMO: "*Nucleus for European Modelling of the Ocean*"
- Model is run on a cloud server for website. Independent of local factors.
- System is available to be downloaded and used locally.
- Forecasts no longer updated, but website is still online



“Live” forecasting of total water level around Madagascar

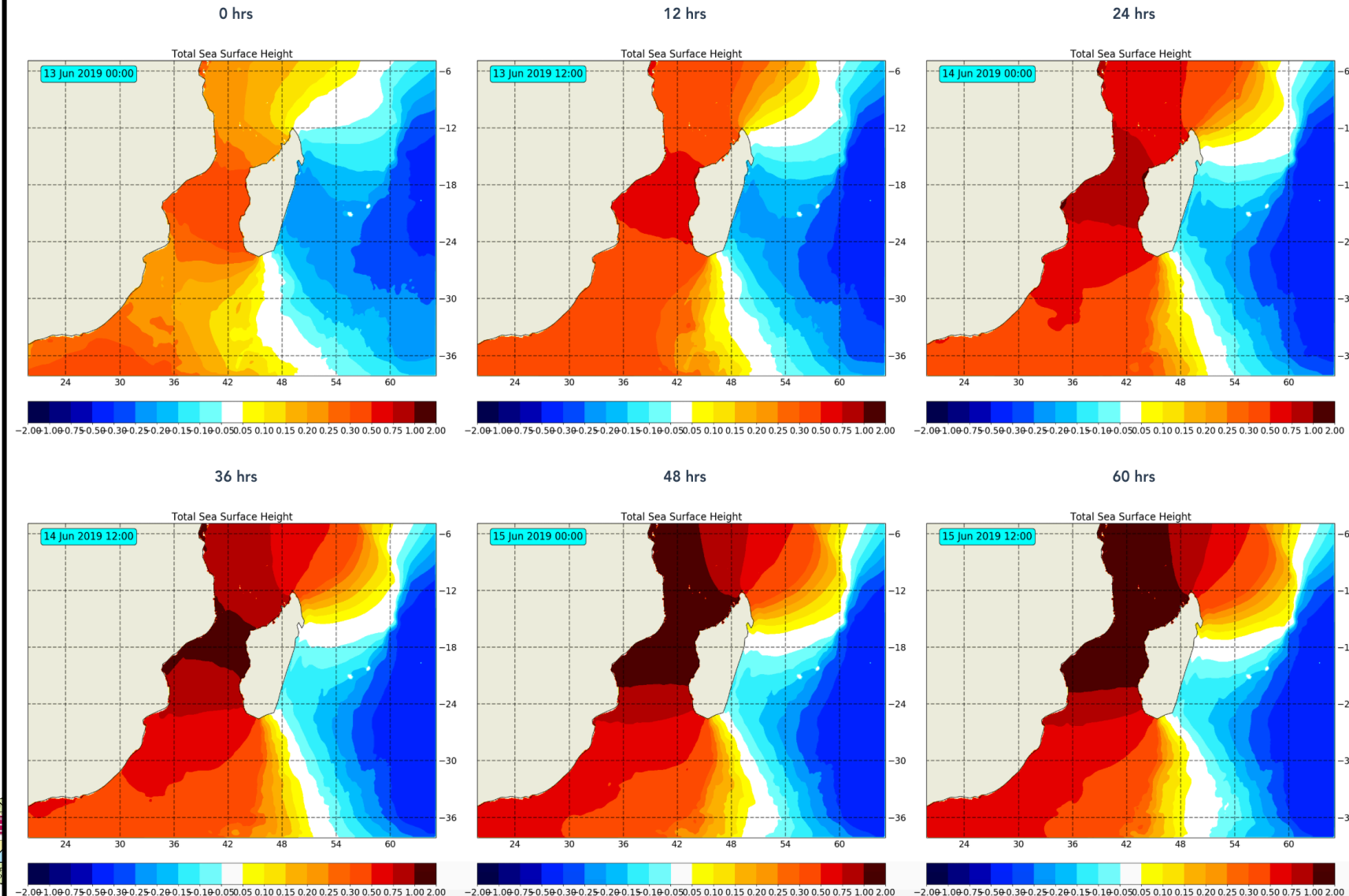
5-day long animation of water levels,
updated daily

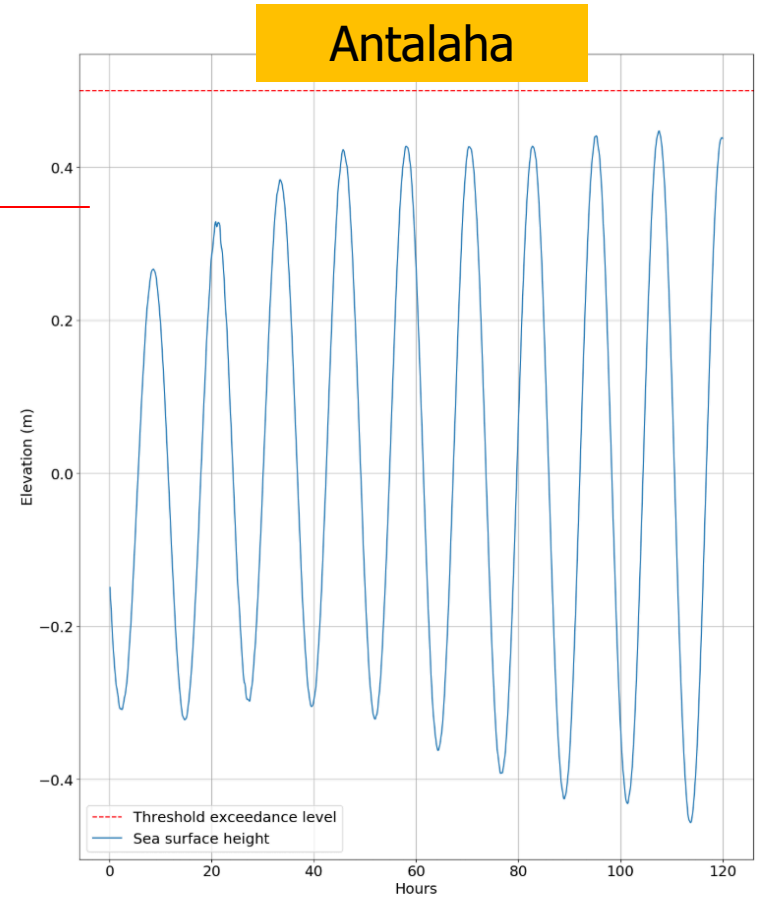
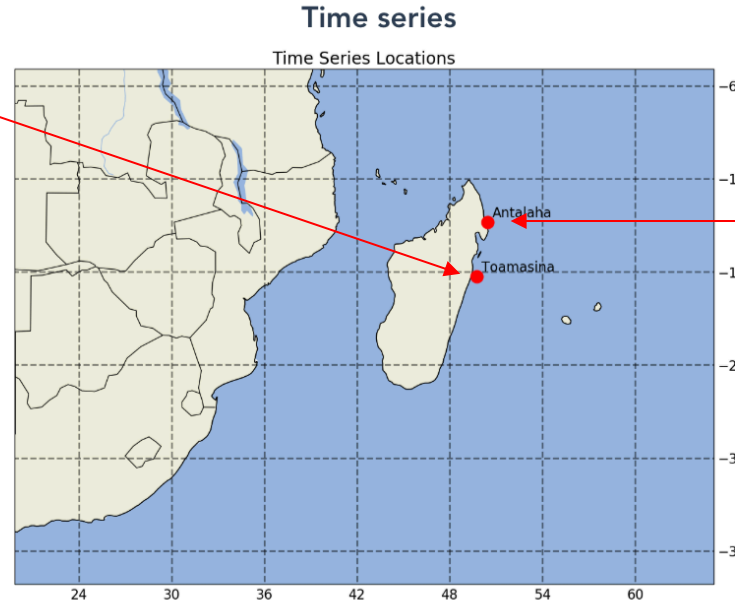
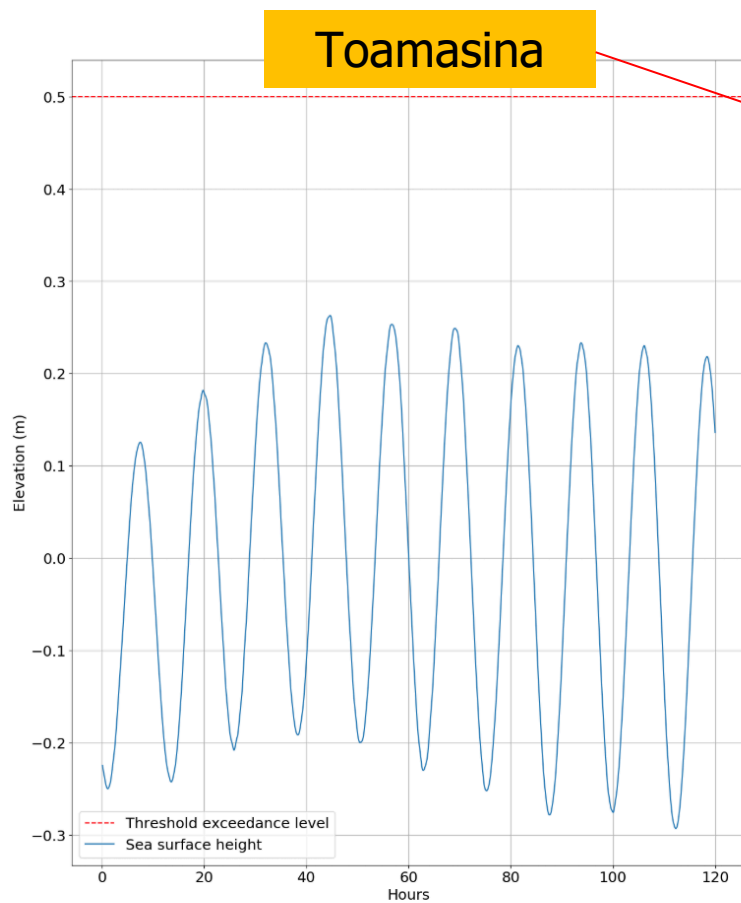
- Tides can be seen
- No storms in this period
- Useful for: seeing 2D spatial information, see areas at risk (if any), behavior over time



12-hourly 'snapshots'

- Images of sea level forecasts given at set intervals (12 hourly)
- Useful for: more presentable format

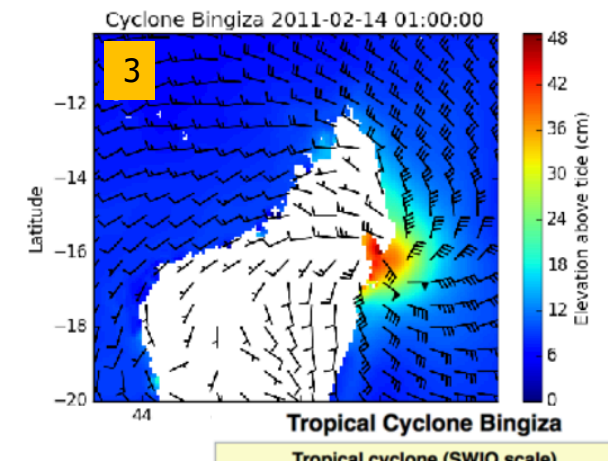
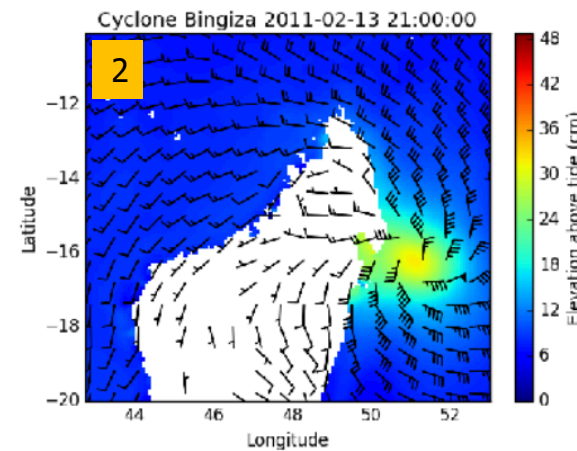
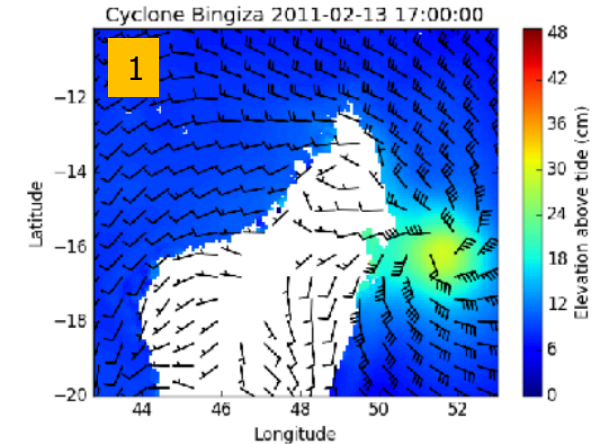
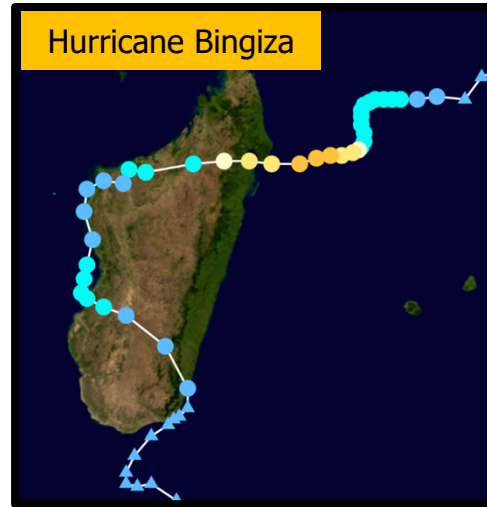




CRISC: Hurricane Modelling

Modelled 65 hurricane storm surges between 1991 – 2015.

- These can be thought of as ‘retrospective forecasts’.
- Shows areas most at risk from the storm surge
- ‘Bulge’ can be seen due to low atmospheric pressure
- ‘Piling up’ of water against coastline due to strong winds can also be seen.



Merci d'avoir écouté

Summary

- Water level at the coast is changing all the time: waves, tides, storm surges.
- Storm surges are an increase in coastal water level due to the weather.
- Storm surges pose large risk to coastal communities.
- C-RISC was project to create flexible storm surge forecasting for anywhere.
- Forecast system created for Madagascar. Demonstration can be viewed online <https://surgedemo.z16.web.core.windows.net/>